Sediments and Stormwater Runoff to the Great Bay, NH

Great Bay Siltation Committee

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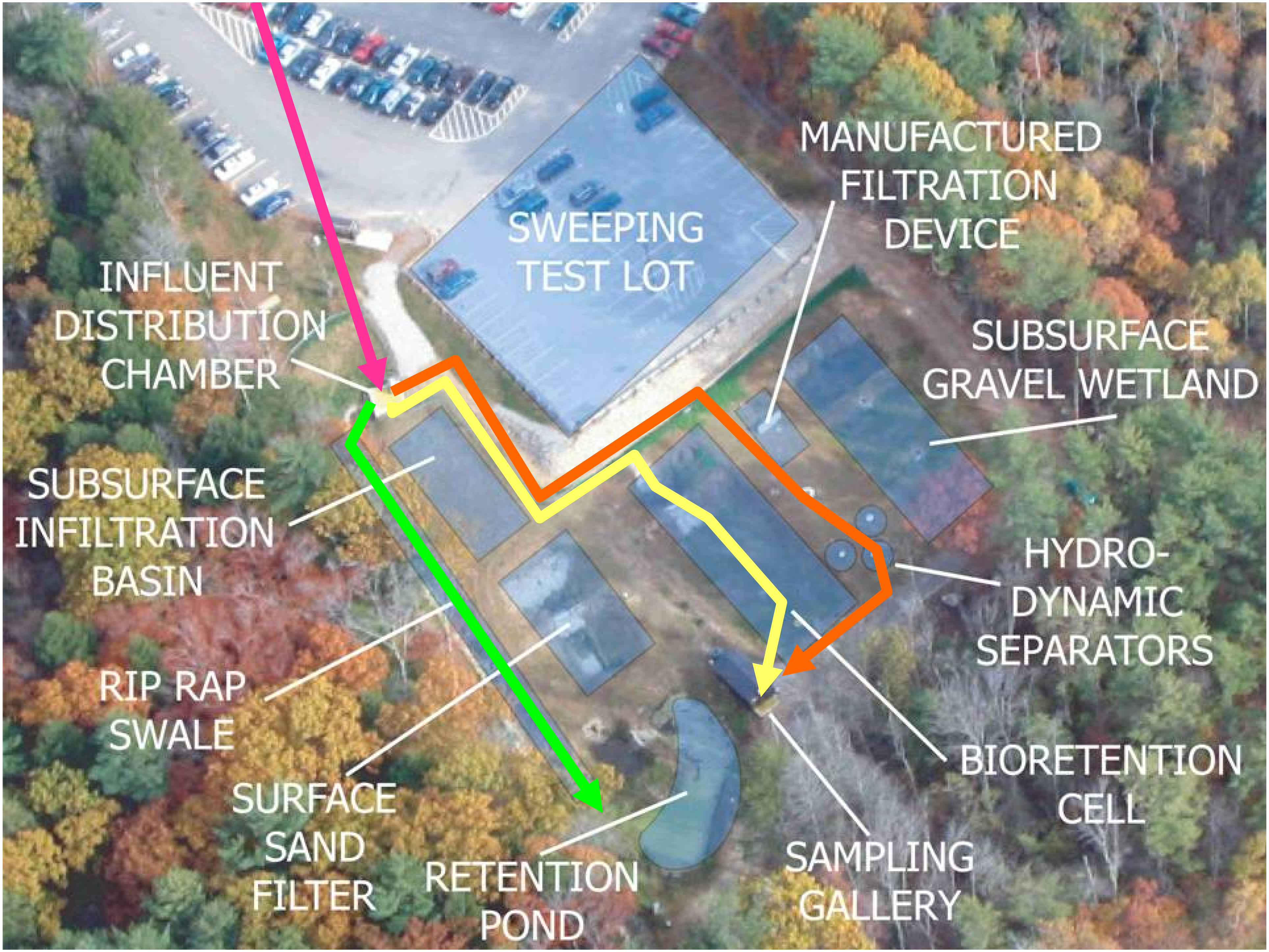
The UNH Stormwater Center
Durham, New Hampshire

1. Research and development of stormwater treatment systems

2. To provide resources to stormwater communities currently involved in design and implementation of Phase II requirements

http://www.unh.edu/erg/cstev


SWEEPING TEST LOT
MANUFACTURED FILTRATION DEVICE
INFLUENT DISTRIBUTION CHAMBER
SUBSURFACE GRAVEL WETLAND
SUBSURFACE INFILTRATION BASIN
HYDRO-DYNAMIC SEPARATORS
RIP RAP SWALE
BIORETENTION CELL
SURFACE SAND FILTER
RETENTION POND
SAMPLING GALLERY

Hydrodynamic Separator

Isolator Row

Subsurface Infiltration

Filter Unit

Porous Asphalt

Pervious Concrete

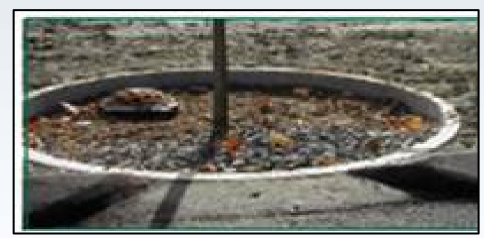
Retention Pond

Rip Rap Swale

Gravel Wetland

Sand Filter

Bioretention Unit



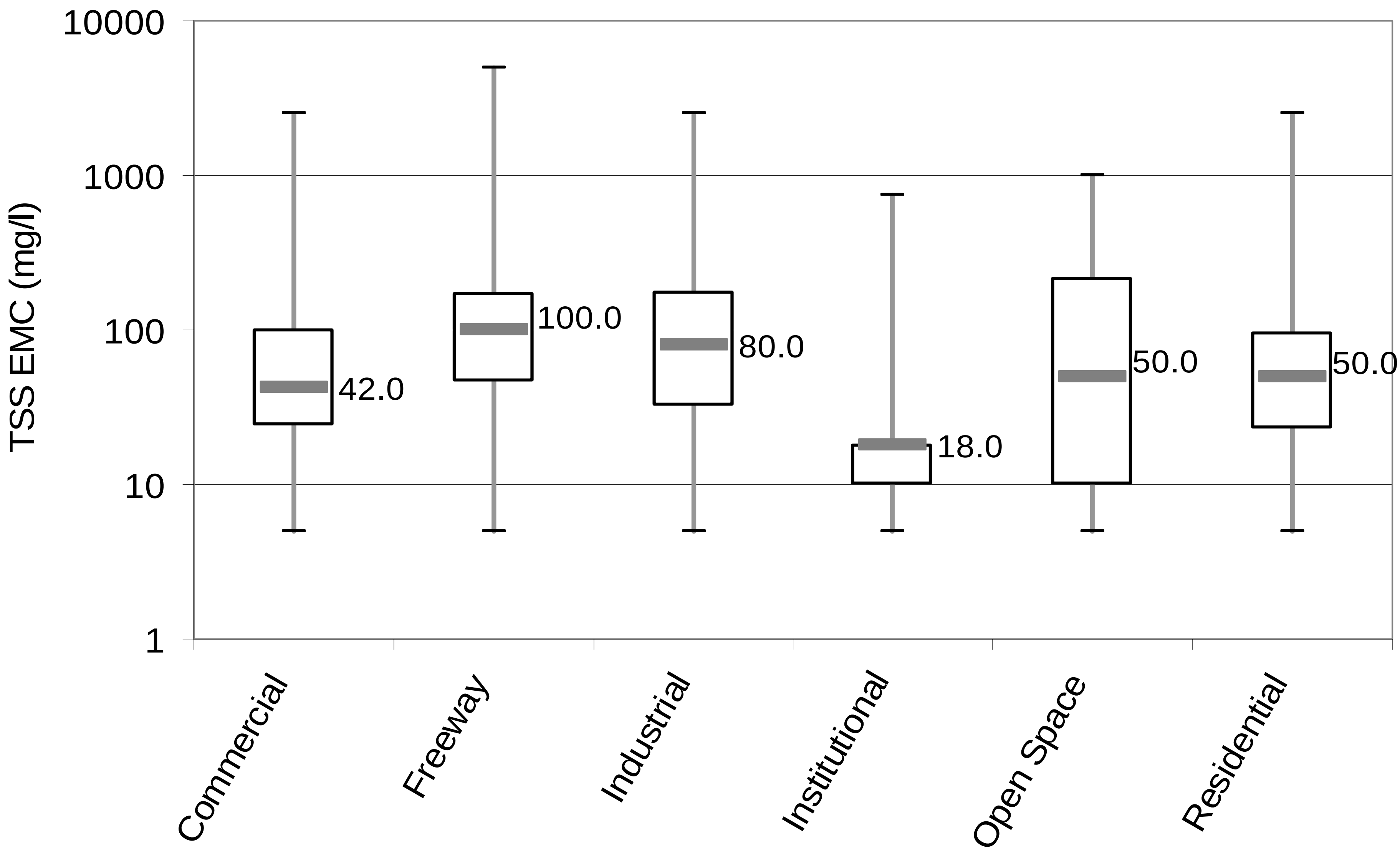
Tree Filter

Why Stormwater? Water Quality

- Sediment is the #1 stormwater contaminant
- Stormwater runoff is the #1 pollution source, out of fourteen identified non-point sources
- Sediment is both a direct and indirect result
- Directly by washoff from urban infrastructure, construction, and agriculture
- Indirectly through erosion of streambeds
- One of the simplest indications of SW impacts is routine closure of shellfish beds >1/2 inch of rainfall in 24 hours
- It is a byproduct of poor stormwater management

Sources of TSS by Land-Use

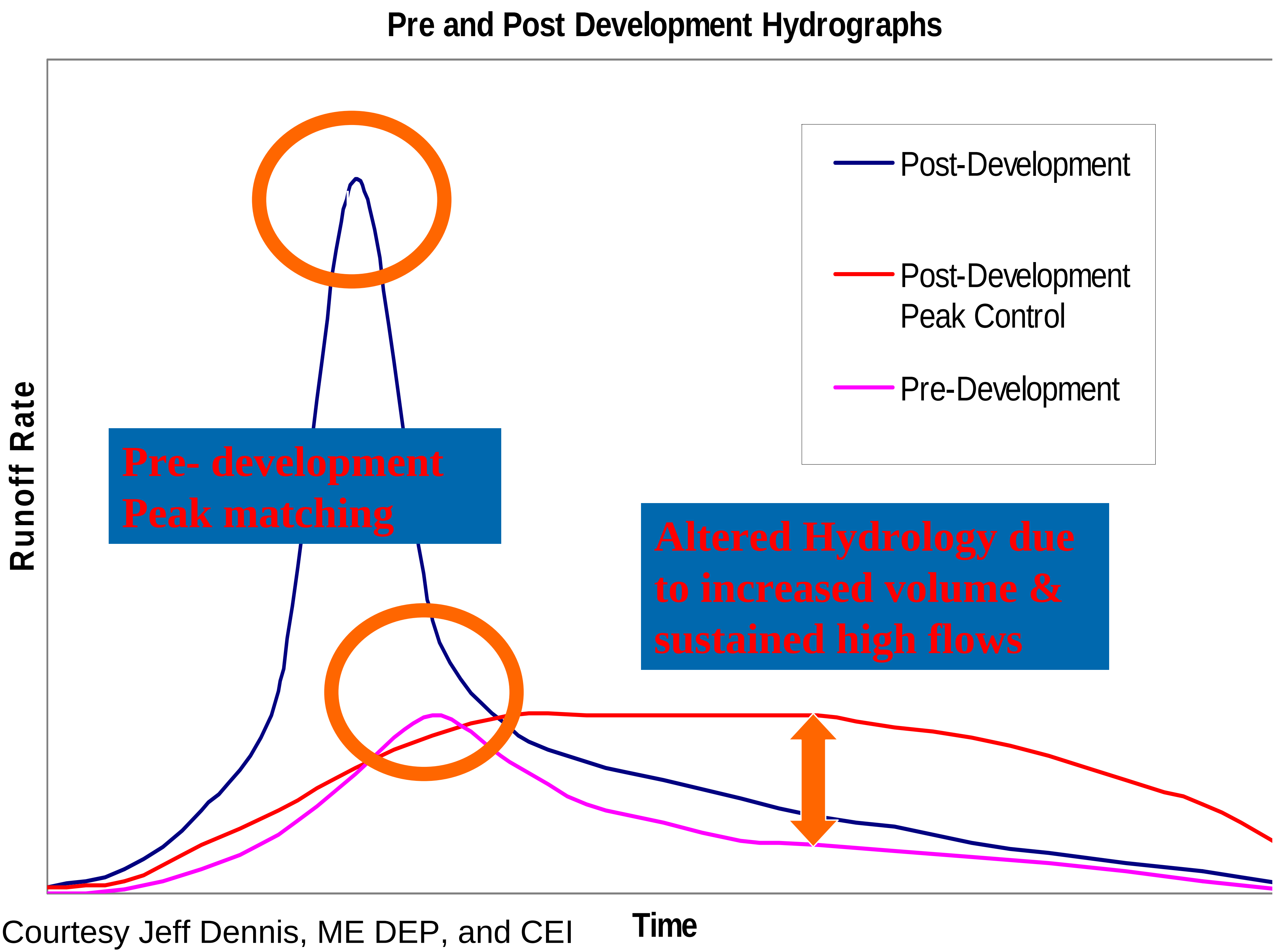
(Pitt, 2004)



Limitations to Conventional Stormwater Management

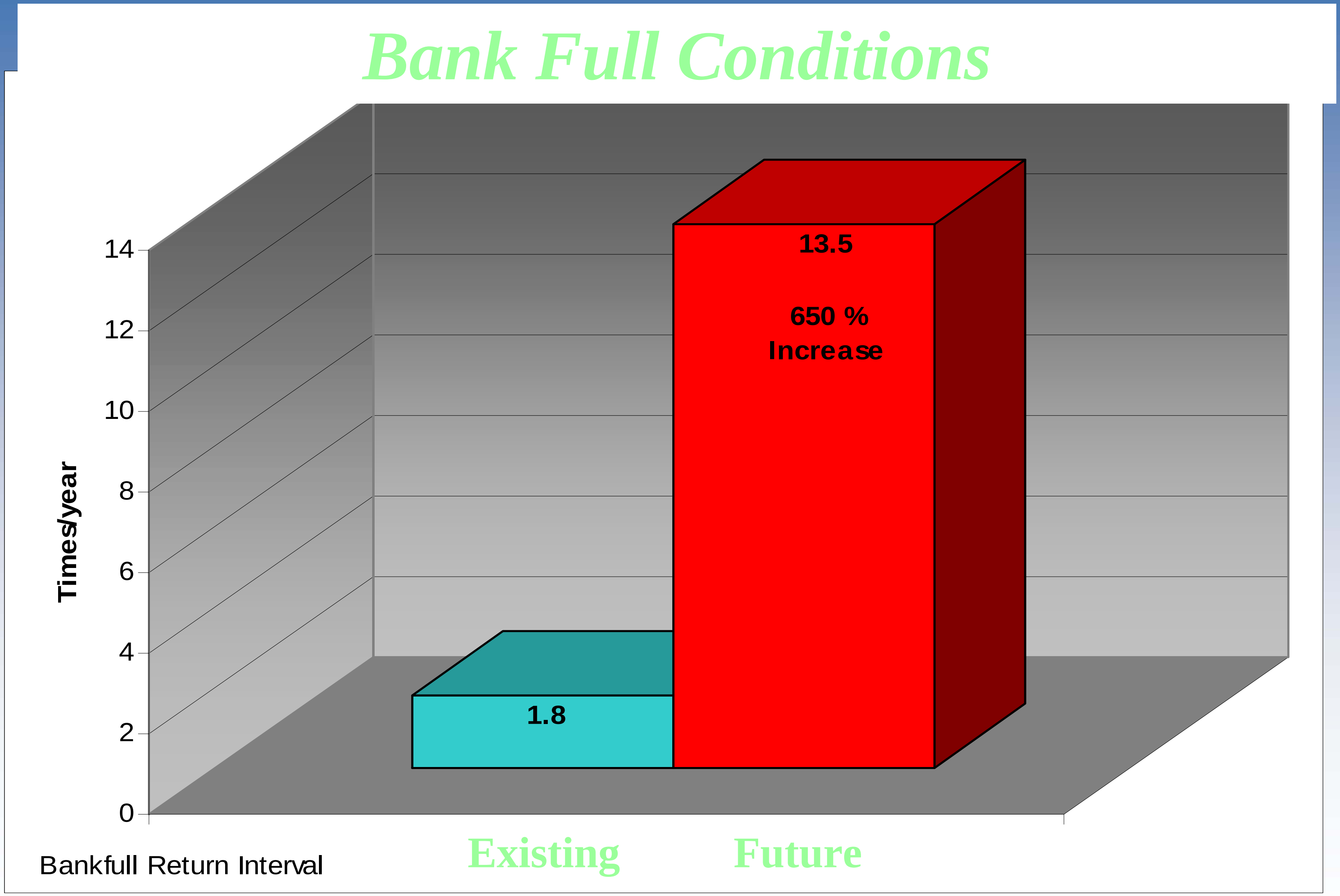
Conventional Stormwater Management

- Retention/Detention---flood control
- Conveyance----swales, catch basins, gutters
- No recharge or water quality components

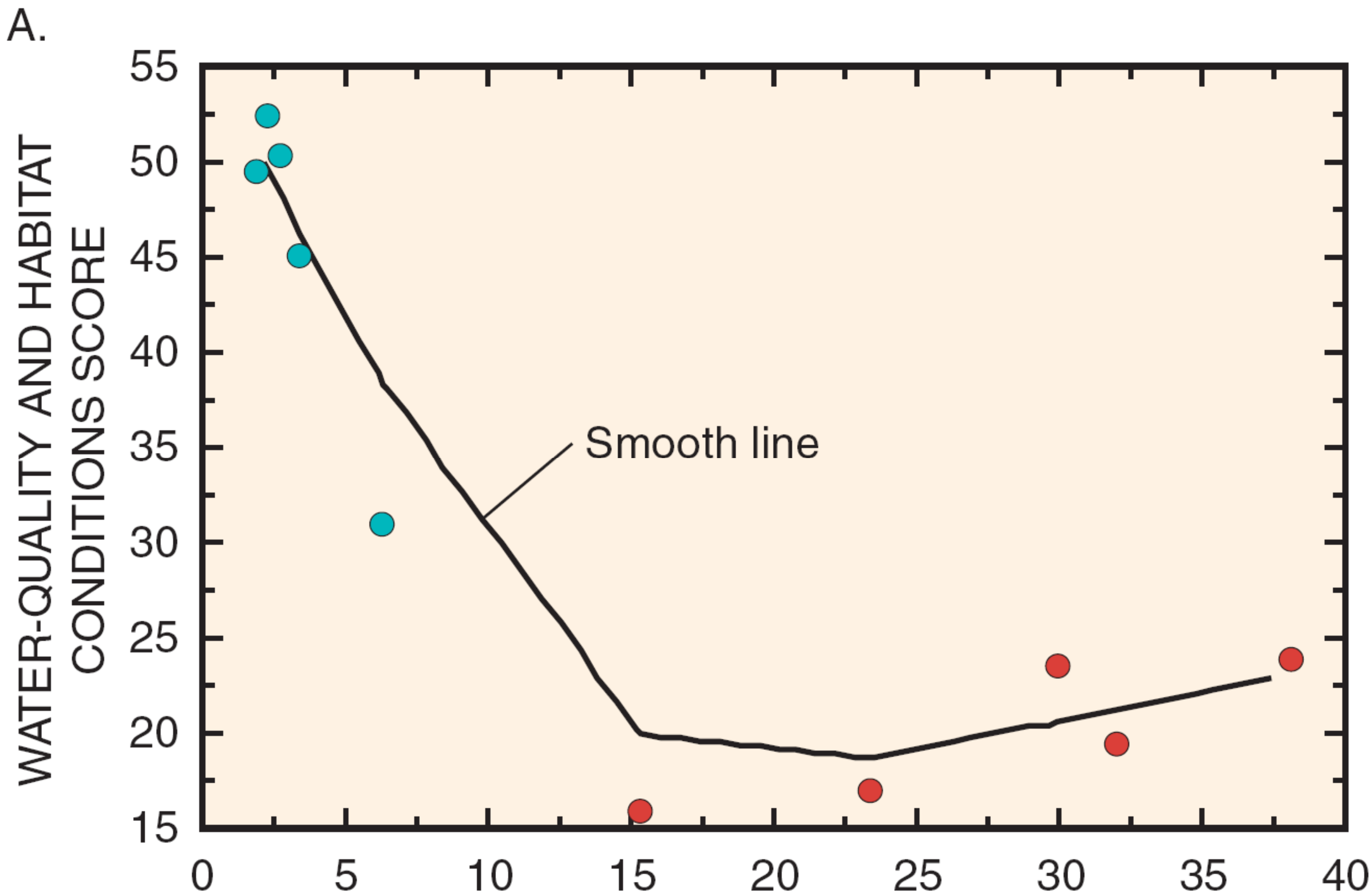


Courtesy Jeff Dennis, ME DEP, and CEI

Impact of Development



Ecological Impacts of Imperviousness and Hydrologic Alterations



1. Inadequate Pollutant Removal

- Traditional approach – total suspended solids
  - TSS removal does **not** equal pollutant removal
  - Focus is coarse particles
  - Majority of nutrients, heavy metals and hydrocarbons are dissolved or associated with finer particles

2. Inadequate Cooling

- Elevated temperatures
  - Hot roofs and pavement
  - Warming in ponds
  - Reduced shading
- Many current BMPs don't cool the stormwater discharge

3. Inadequate Stream Channel Protection

- Traditional approach – peak control only
- Does not reduce volume of runoff
- Results in longer exposure to erosive flows
- Only applied to infrequent storms (i.e., 2-yr, 10-yr, 25-yr or greater)
- Does not address more frequent storms (i.e., 3-month, 6-month, 1-yr)

Solutions

Goals for Future SW Control

- ***The Primary Cause of WQ Degradation is Altered Hydrology***
- ***Can be Corrected By LID design:***
  - ***Storm volume reduction through infiltration*** thereby replacing lost hydrologic functions from impervious surfaces by reducing hydrologic footprint
  - ***Water quality treatment by filtration*** of stormwater through engineered soil media which replaces the lost treatment benefits of natural soils.

Low Impact Development

Modeling designs after natural systems to maintain pre-development hydrology

LID vs Infiltration

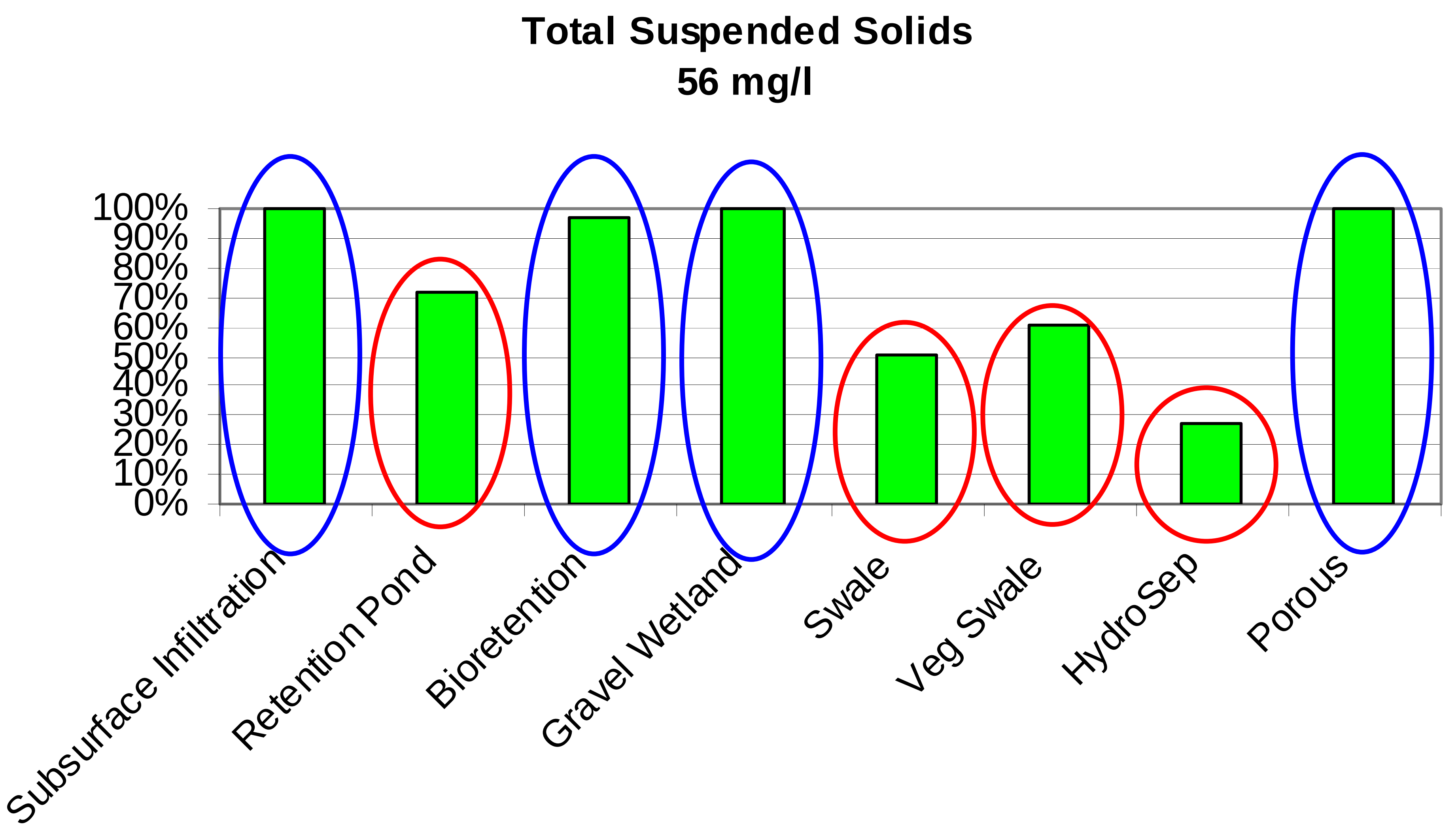
- LID strategies are appropriate for nearly every application
- Infiltration has more limited application due to: resident soils, threat to groundwater

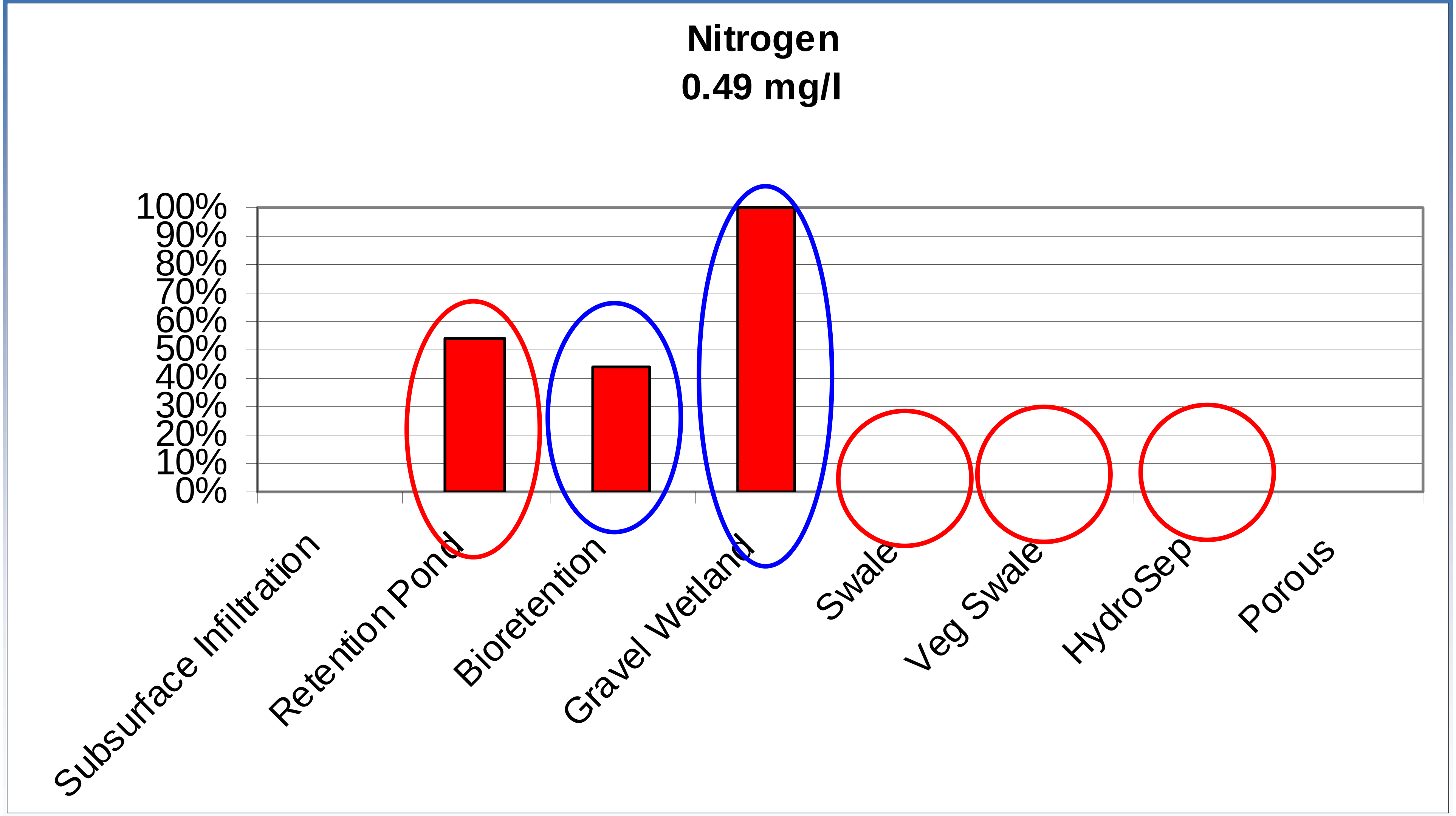
LID Stormwater Management Objectives

1. Effective Pollutant Removal by filtration
2. Cooling
3. Channel Protection
4. Flood Control-infiltration
5. Recharge-infiltration

Why are we interested in Infiltration? Recharge?

- Much of the traditional stormwater controls focus on peak reduction and quantity control, but not quantity reduction
- Many LID approaches use infiltration/filtration for reducing runoff volume
- Reduced volume translates to smaller treatment volumes


Total Suspended Solids
56 mg/l
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Subsurface Infiltration
Retention Pond
Bioretention
Gravel Wetland
Swale
Veg Swale
HydroSep
Porous



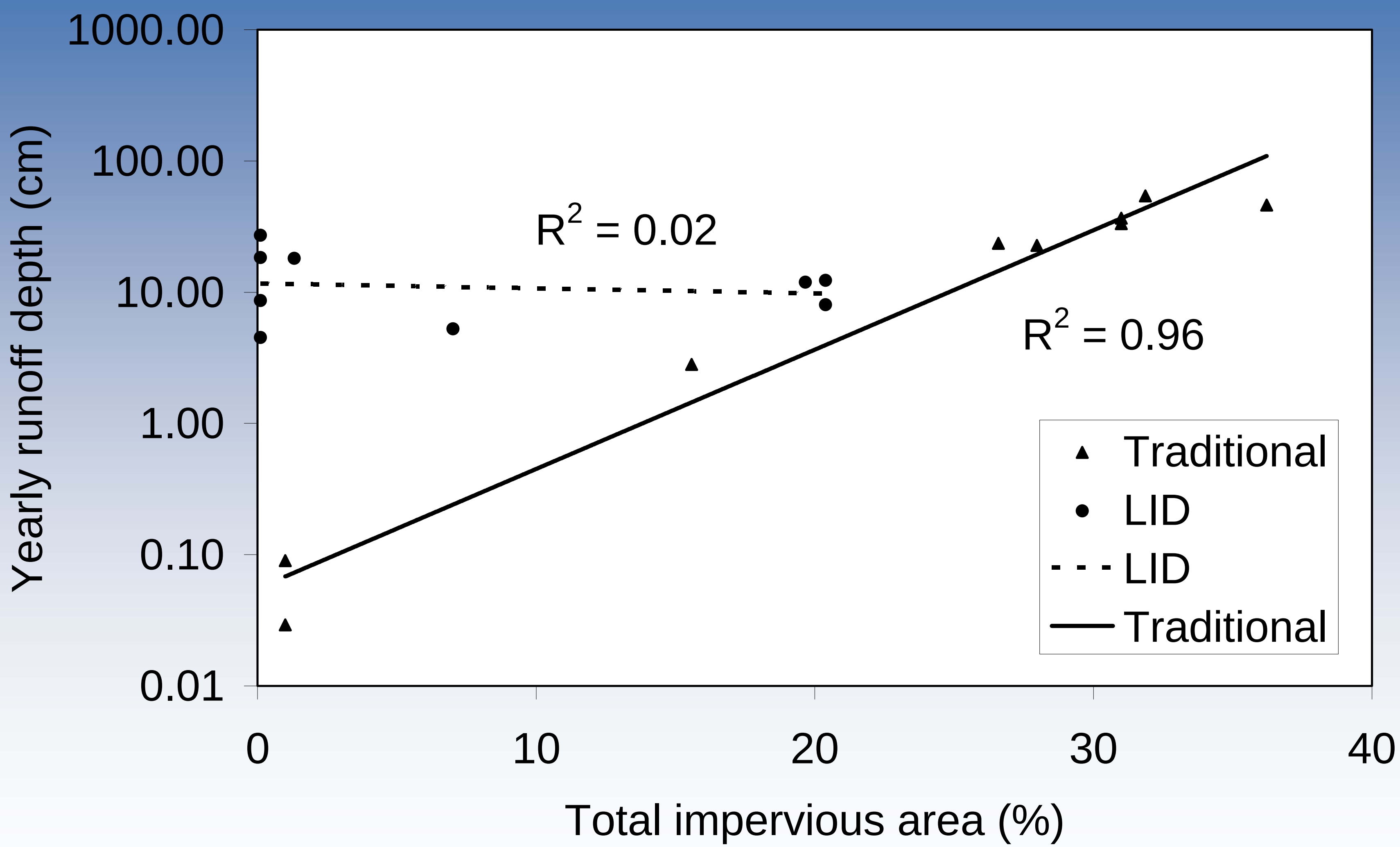
Nitrogen
0.49 mg/l
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Subsurface Infiltration
Retention Pond
Bioretention
Gravel Wetland
Swale
Veg Swale
HydroSep
Porous

LID Site Design, Does it Really Work?

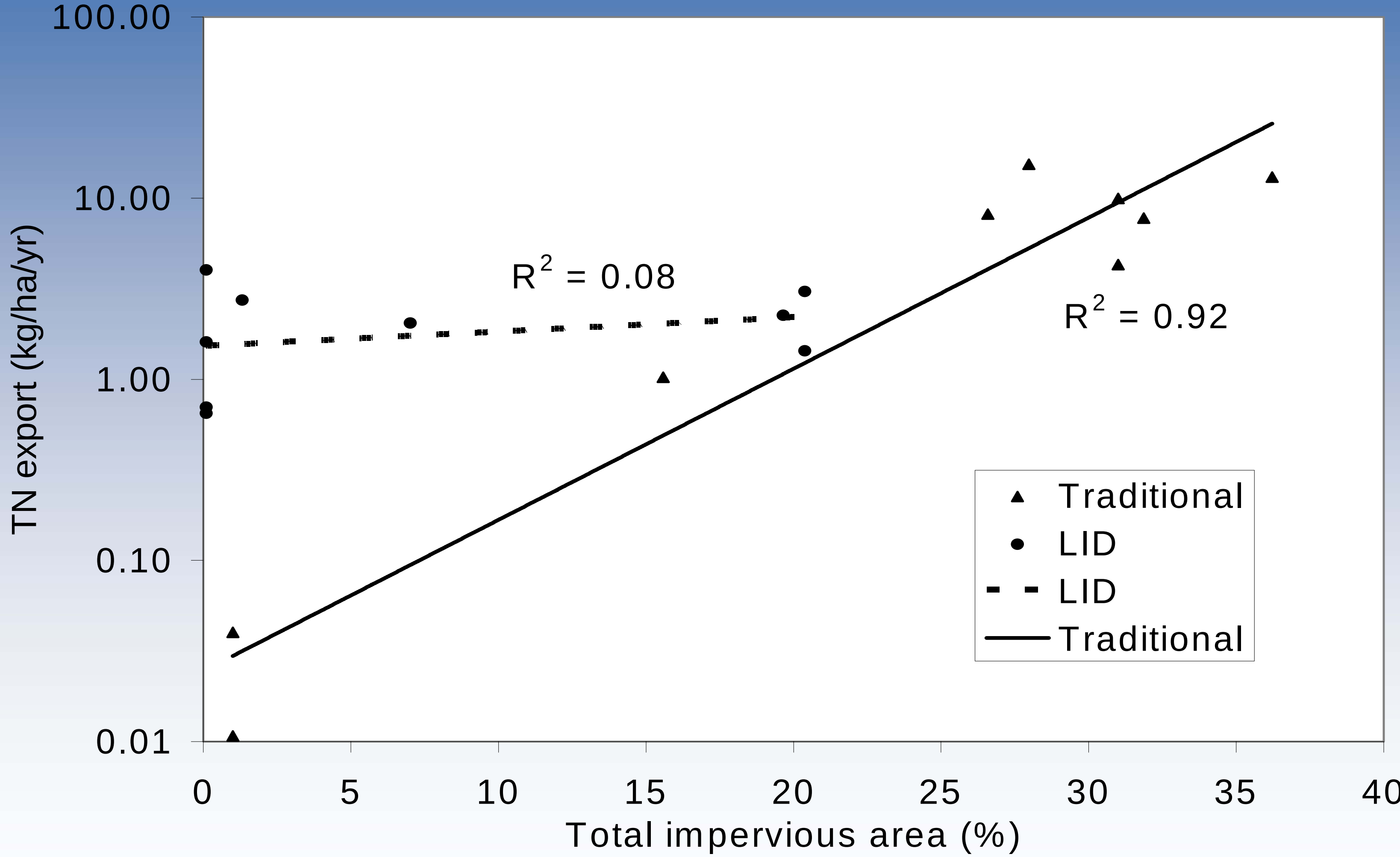
Jordan Cove Project, USEPA Funded

Dr Jack Clausen and Dr Michael Dietz

LID Design Results for Runoff Depth-- Jordan Cove



LID Design Results for TN Export -- Jordan Cove



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Regulatory Setting

Regulatory Drivers

- Full implementation (2008) compliance with Phase II SWMP requires innovative BMP usage—began in 2003
- Clearly conventional stormwater management will not be able to meet a “no net increase” standards
- Low impact development designs will be an integral component of stormwater management to meet these requirements

Phase II and TMDL

- Phase II is largely an issue of due diligence with respect to SWMP
- TMDLs are solid WQ standards—due diligence does not matter
- TMDL enforcement has begun but will be widespread by 2012

Phase II Grants the Authority

- MS4 operators are required to design a program that:
  - Reduces the discharge of pollutants to the “maximum extent practicable” (MEP)
  - Protects water quality
  - Satisfies the appropriate water quality requirements of CWA
- MEP compliance requires the successful implementation of approved BMPs.
- Phase II grants MS4s the authority to use these technologies and do not need state or local authority

New and Pending Legislation

- LID legislation is becoming widespread: 2007 Rhode Island General Assembly,
  - Act H6134, *Smart Development for a Cleaner Bay* (RIGA, 2007)
  - Requires statewide LID beginning July 2008
- Amherst, and New London, NH have passed LID requirements
- MADEP will be releasing new stormwater manual and rules any day
- NHDES has new SW manual in production
- ME, VT, NY, CT all have new updated manuals

New Regulations Require Infiltration

Hydrologic Group	NHDES	MADEP
A: gravels, sand, loamy sand or sandy loam	0.40	0.6 inches of runoff
B: silty loam	0.25	0.35 inches of runoff
C: sandy clay loam	0.10	0.25 inches of runoff
D: clay, silty clay loam, sandy clay, silty clay	Not required	0.10 inches of runoff

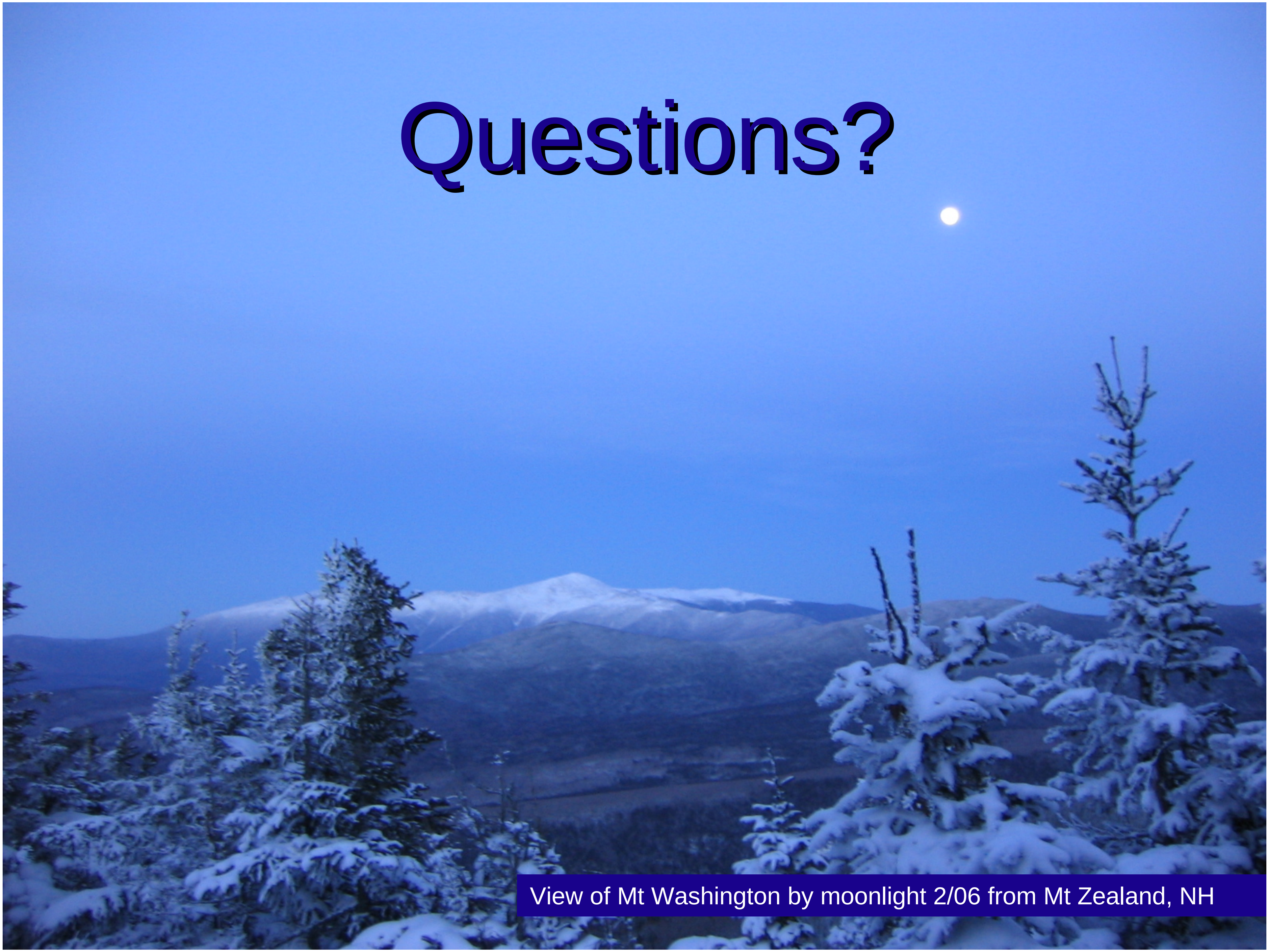
LID and Climate Change

- Recent research* examining impacts of climate change on rainfall depths (28-60% increase) demonstrated existing urban infrastructure (culverts) will be under-capacity by 35%
- There are 2 near-term achievable solutions:
  - Upgrade infrastructure--$$$$
  - Implement wide-scale LID requirements

*Y. Guo, 2006

Acknowledgements

Questions?



View of Mt Washington by moonlight 2/06 from Mt Zealand, NH